3- combination of modes

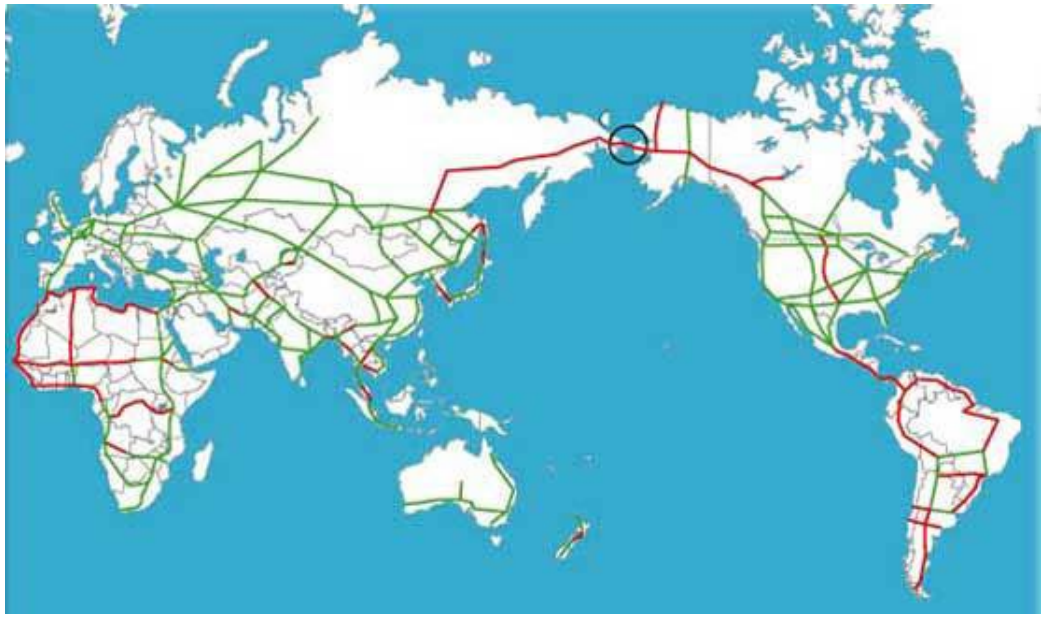
- Airway
  - Air freight traffic
  - Intermodal air-surface containers
  - Improving aircraft turnaround
- Air / road
  - Road transport connected with long distances
  - Intermodal movements by air
    - The nature of air cargo
    - Growth in air freight cargo
    - Planned intermodality helps airfreight economics

3-

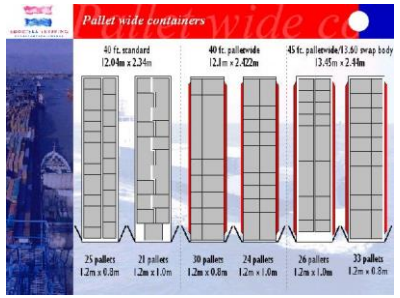
Sea-air intermodal operations	• Availability of aircrafts • To maximize sea use • Large industrialized centers
Sea air to China	
Difficulty in tracking sea air shipments	• Smaller or bigger aircrafts • Air-ground alternative
Convenient corridors	• Far East to Europe • North America / Asia
Intermodal containers	• Weight inconvenience

- Offer evolution
  - Longer distance, less energy
  - Container size to fit aircraft
  - Lower deck containers
  - Unit load device
- Thus smaller airplanes increasing presence
- Intermodal facilitators
  - NVOCC approach
  - The compulsory international air cargo agents
- Integrated carriers
  - Door to door service compared with airlines' competitors

- Sea shipping services
  - Deep sea
  - Land bridges
    - Sea land or sea land sea route
    - Flat rate
    - Important international trade routes
  - Land bridge train



- Minibridges : through bill of lading - TBL
- Micro bridges
- Existing port adjacent intermodal facilities
  - Port terminal
    - Road sea and rail sea traffic
    - Ships – railway tracks
  - Transfer of containers
    - Container handling equipment
      - Fittings – handling – be stacked – eight high
      - Oval shaped holes – Inter Box Connectors
      - Oversized forklifts



- Sea/rail/road/inland waterways
  - By sea and one or more inland transport
  - Combination containership/LASH ocean vessels
  - A wide range of cargo
  - Rates are lower
  - Connections water / deep-sea
  - Hybrid vessels are in the minority
  - Combination vessels

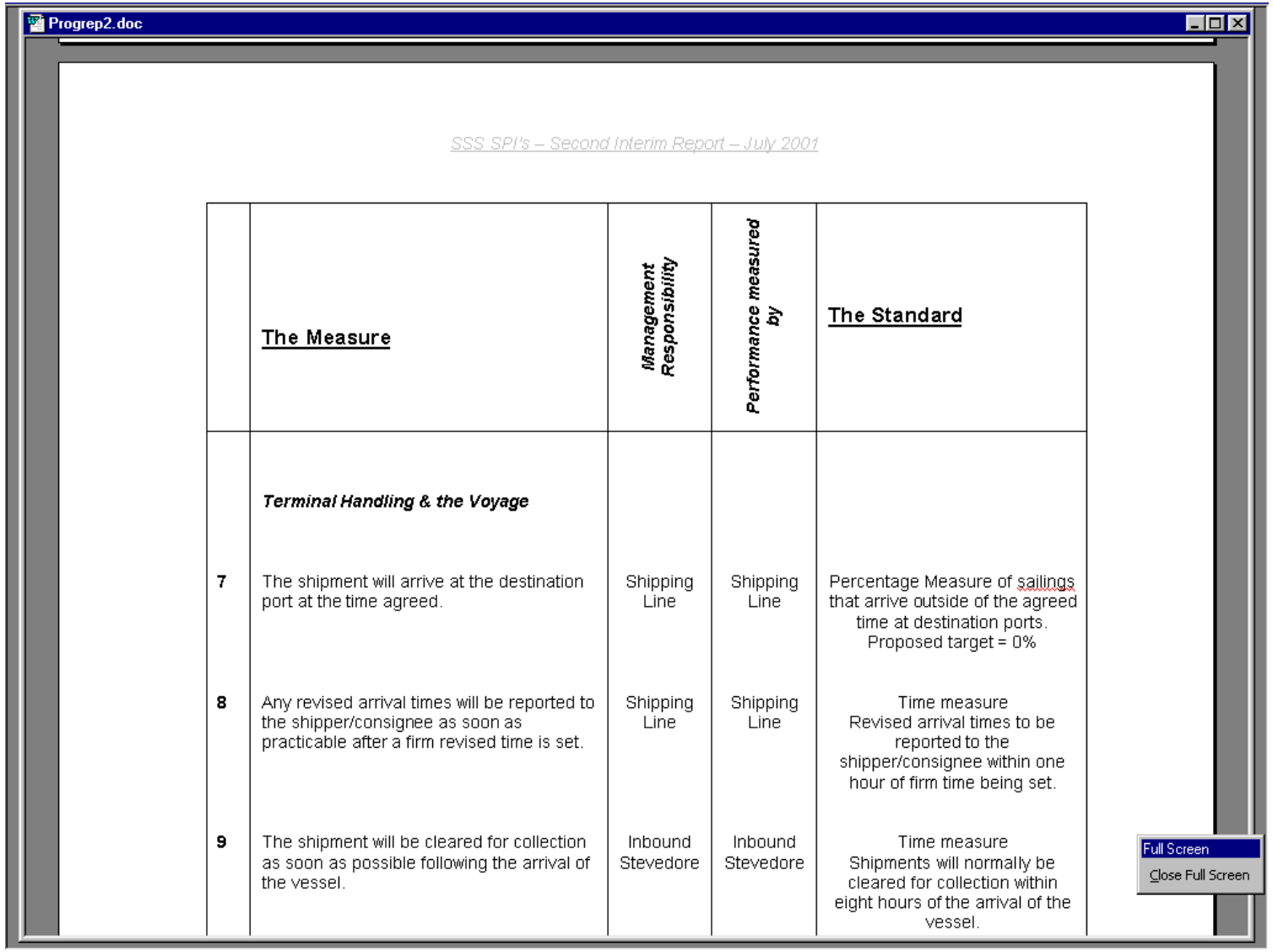
MT COURSE Frédéric Gauthier

Dunkirk example

Example

Examples

4-



	The Measure	*Management Responsibility*	*Performance measured by*	The Standard
	Terminal Handling & the Voyage			
7	The shipment will arrive at the destination port at the time agreed.	Shipping Line	Shipping Line	Percentage Measure of sailings that arrive outside of the agreed time at destination ports. Proposed target = 0%
8	Any revised arrival times will be reported to the shipper/consignee as soon as practicable after a firm revised time is set.	Shipping Line	Shipping Line	Time measure Revised arrival times to be reported to the shipper/consignee within one hour of firm time being set.
9	The shipment will be cleared for collection as soon as possible following the arrival of the vessel.	Inbound Stevedore	Inbound Stevedore	Time measure Shipments will normally be cleared for collection within eight hours of the arrival of the vessel.

Sum up

Rank modes combination in easy or not and why ?

Part IV- continental distances

1- continental loading units

2- Continental modes

3- India

4 – European Union

5 – multicontinental issues

6- case studies

Table 2.4 Comparison between the container and semi-trailer shipping segments

Factor	*Container*	*Semi-trailer*
Geographic transport market	Trans-ocean/deep sea/ short sea	Intra-European/short sea
Modal competition	Air for deep sea leg Rail and road for feeder leg	Rail and road + fixed connections
Business priority	Utilising economies of scale	Providing customer convenience
Port geography	Few large hub ports + feeder ports	Many ports – partly bridge substitute
Hinterland depth	Deep	Shallow
Transport time/speed	Fast	Fast
Precision	Day	Hour
Order time	Week	Day/minute
Frequency	Weekly	Daily/hourly
Transport service coordinator	Shipping line, line agent or sea forwarder	Shipper, road haulier or general forwarder
Cargo dwell time in port	Days	Accompanied – minutes or none Unaccompanied – hours
Empty unit dwell time	Days/weeks	Hours/days
Port work content	Substantial	Limited
Rail technology	Very simple – flat wagon/ twist-locks	Complicated – pocket wagon/ king-pin box
Road technology	Awkward at end points	Simple and accessible
Road-rail transhipment technology	Fairly simple – automation possible	Dimensioning factor in weight and handling

Source: Woxenius, J. and Bergqvist, R., *Journal of Transport Geography*. 19(4), 680–688,

1- Continental loading units

Missing interoperability

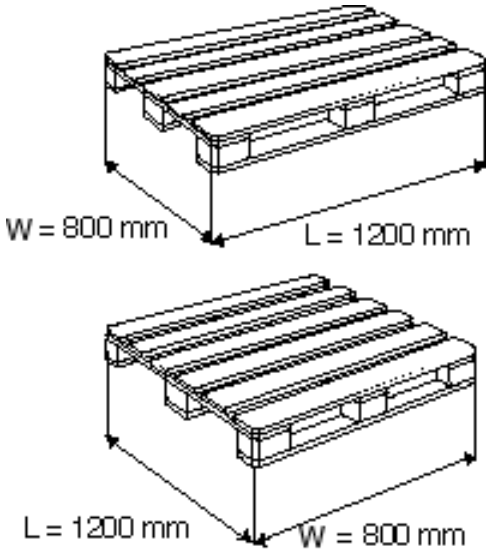
- Unit load

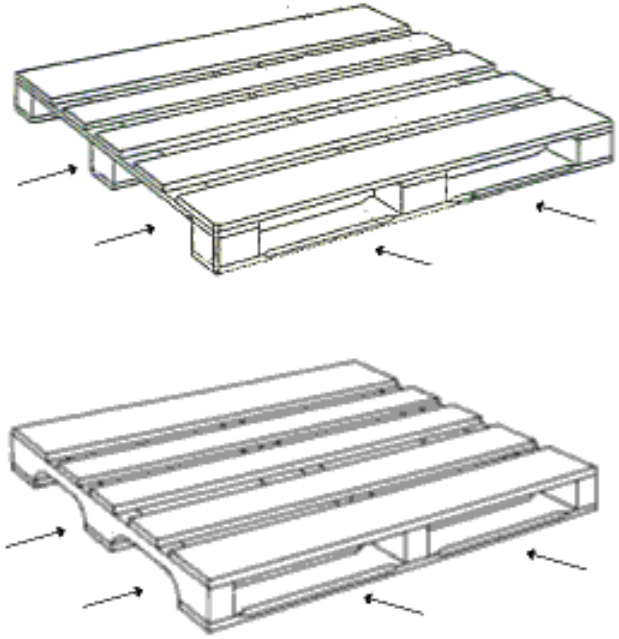
Pallets

- From start to finish : efficient handling
- Stability
  - Might be shrink wrapped
  - Carton glue and corner boards
- Numerous materials
  - Wood, steel, aluminium, plastic, corrugated fibreboard
- Single trip …. Or not

Pallet

4 ways entry of 2 ways entry





- Loading unit
  - Intermodal transport unit
  - European size containers
    - 45’
  - Swap body
    - To road vehicle dimension
  - Bi modal semi trailer
    - Less used
  - Low floor wagon
    - To carry ITUs
  - Pocket wagon
    - To accept axle/Wheel
  - Basket wagon
    - Demountable subframe
  - Rolling road wagon
    - Low floor wagon for rolling road

Swap body

Pocket wagon

Continental modes

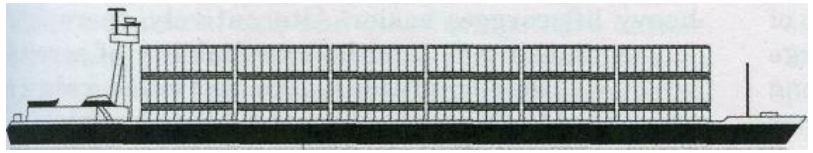
- Short sea shipping
  - Short distances
  - Advantages
    - Energy use
    - Extra capacity
  - Inconvenience
    - Long lead time
    - Low reliability
  - Feeder services
    - Liner services
    - With long distances traffic density decreases
  - RORO services
    - Including unaccompanied intermodal transport
  - Barge
    - Can moor to parallel tracks

Continental modes

- Inland waterway terminal
  - To offer trimodal terminals
- Waterways shipping
    - Intermodal movements by coastal and inland waterways
- European Inland waterway services
  - The Rhine key river
    - Hinterland terminals
    - Number of calls
    - Possible dwell time at sea port
- Rhine and … Danube
  - 2 millions containers estimation in Rotterdam
  - Roll on Roll off to avoid Switzerland for heavy trailers
  - Duisburg
    - From 110000 containers in 1990 to more than 2 500 000 containers today

2-

Different types of inland waterways service



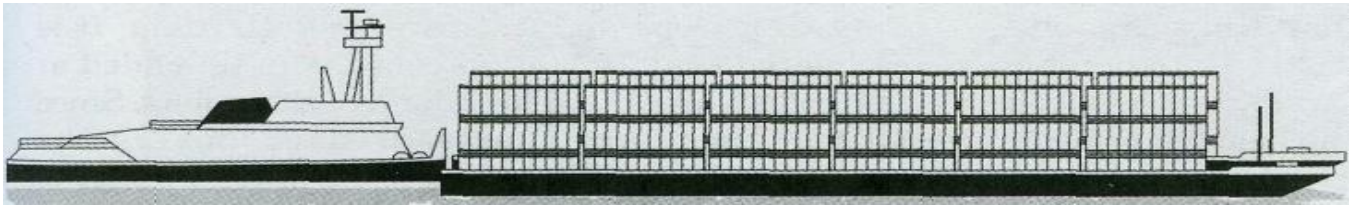
EUROPASCHIP

Typical container capacity per ECMT class.

Class		Typical TEU capacity	Typical TEU configuration (l x w x h)
II	Kampine barge	24	6x2x2
III	Dortmunder	54	9x3x2
IV	European class	90	10x3x3
Va	Rhine vessel	208	13x4x4
Vb	1x2 push barge	384	13x4x4 + 11x4x4
VIa	2x1 push barge	352	Twice 11x4x4
VIb	2x2 push barge/ largest motor vessel	450-500	

** no container traffic in Classes 0 and I

EUROPEBARGE



KOPPELVERBAND

- Infrastructure
  - Canal, locks and bridges
- River ports to challenge as Duisburg
- IWT Classification examples
- Connecting inland, coastal and ocean services at stake
- European coastal services
  - Developping in the U.S., to make fewer ship calls
  - Bremen to Hamburg and Scandinavian ports
    - 100 to 400 TEUS capacity, more than 16 knots speed
  - Short Sea Shipping Rotterdam
    - Oil, containers, fruits, coal, ore, scrap metal reach in 24 hours European ports
  - Amsterdam Portugal equivalent to 180 000 trucks a year
  - Black Sea: RoRo developping : Turkey, Russia, Eastern Europe
  - Baltic sea more than 400 ports with over 950 millions tonnes a year
- Market rules conditions are depending on ….
  - International Rhine
  - Rhône …
- Larger ocean containerships fewer port calls

Inland waterway network connected to Rotterdam

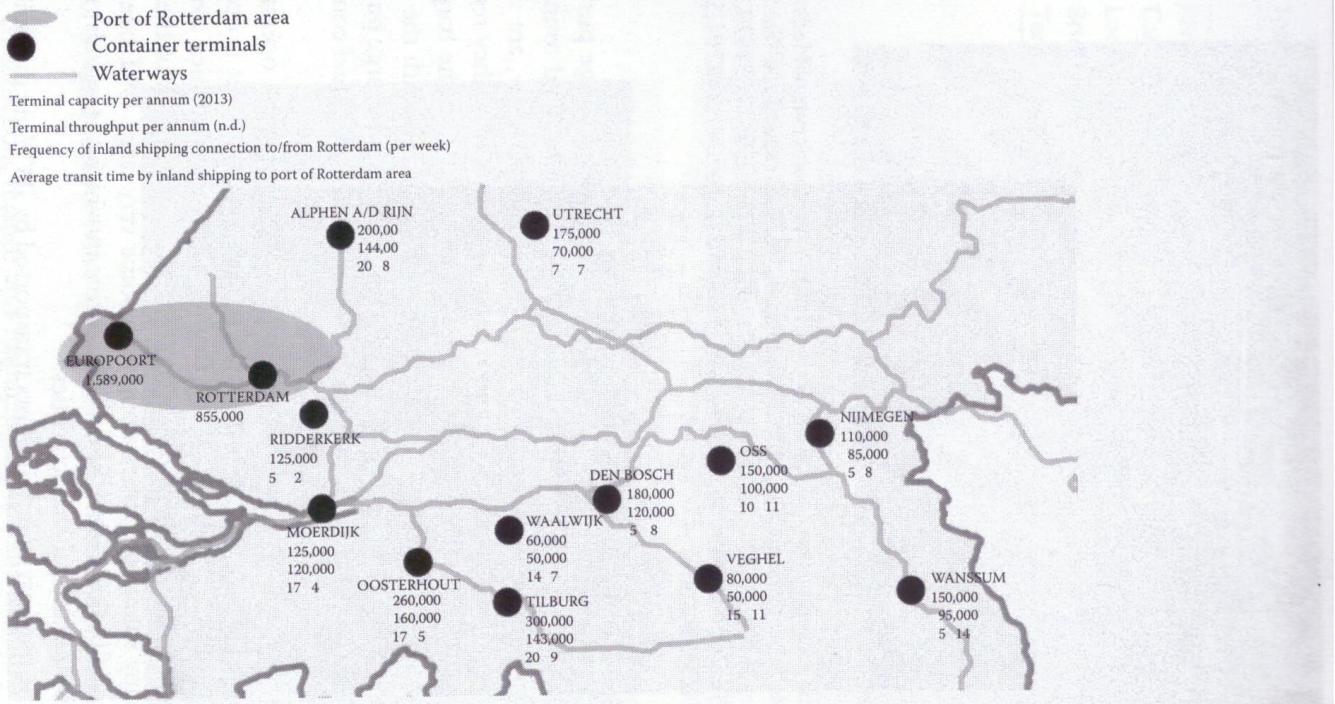


Figure 4.3 IWW network for the Port of Rotterdam. (From Fan, Y., The design of a synchromodal transport system: Applying synchromodality to improve the performance of current intermodal freight transport system, Master's thesis, Delft University of Technology, 2013.)

Table 4.2 Fleet statistics: Number of vessels

	W-Europe	*Europe Danube*	*United States*	*China*
Self-propelled				
Dry cargo	6.753	373	635	n.a.
Tank	1.992	37	2	n.a.
Total#	8.745	410	635	132.000
Push barges				
Dry cargo	3117	2559	23418	n.a.
Tank	155	233	3220	n.a.
Total#	3.272	2.792	26.638	33.000
Pushers	1039	422	3442	n.a.
Total	n.a.	n.a.	n.a.	165.000

Source: Adapted from Hekkenberg, R. and Liu, J., *Inland Waterway Transport: Challenges and Prospects*, Routledge, London, 2016.

IW fleet

4.4 A tugboat pushing barges up the Monongahela. (From https://rutheh.com/2010/03/10/tugboat-pushing-barges-up-the-monongahela.)

Saving load and fuel

Keep in mind global warming and tides as well as water levels

Table 4.4 Factor costs in inland waterway transport (reference date: 2008)

	Measure	*Rhine vessel (Class Va)*	*Rhine-Herne vessel (Class IV)*
Vessel characteristics			
Type of vessel		Motor dry freight vessel	Motor dry freight vessel
Capacity	TEU	208	90
Dimensions (L × W × D)	Metres	110 × 11.40 × 3.60	86 × 10.50 × 3.20
Tonnage	Tons	3.500	2.000
Fixed costs			
Capital costs	€/year	784.750	350.000
Labour costs			
Day operations	€/year	140.000	120.000
Semi-continuous operations	€/year	285.000	250.000
Continuous operations	€/year	660.000	510.000
Variable costs			
Fuel costs			
Loaded vessel	€/km	10	7.54
Empty vessel	€/km	4.78	3.62
Repair and maintenance costs	€/km	0.72	0.37
Overheads	€/year	n.a.	n.a.
Business hours			
Day operations	Hours/year	3.500	3.500
Semi-continuous operations	Hours/year	4.500	4.500
Continuous operations	Hours/year	7.800	7.800
Direct cost hour coefficient			
Day operations	€/hour	264	134
Semi-continuous operations	€/hour	238	133
Continuous operations	€/hour	185	110
Kilometre cost coefficient			
Loaded vessel	€/km	10.72	7.91
Empty vessel	€/km	5.50	3.99

Source: Adapted from NEA (2009).

Discussion

What makes **intercontinental vs continental moves different** as far as transport modes are concerned ?